WATER RESOURCES REVIEW for

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

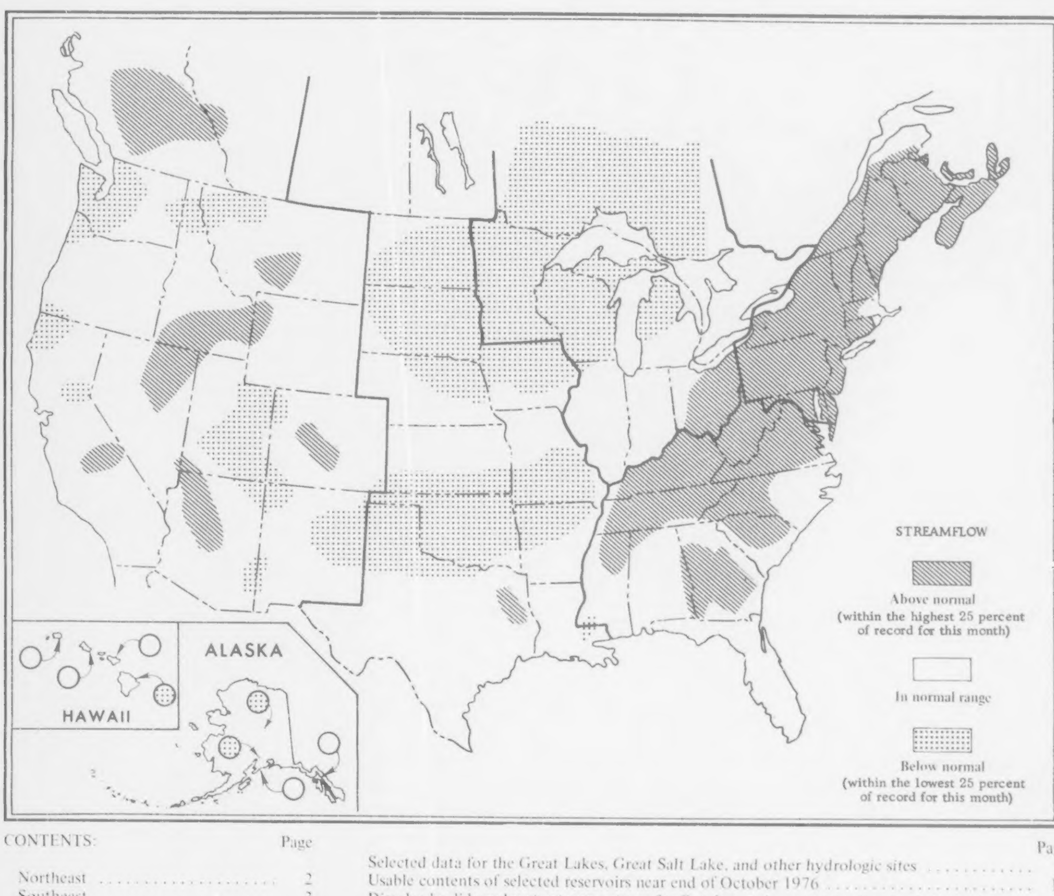
OCTOBER 1976

STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally increased seasonally in the Eastern States and was variable in the Central States and in many Western States and also Hawaii. Flows generally decreased in Alaska, Arizona, California, and Montana.

Flooding occurred in Maryland, Pennsylvania, North Carolina, South Carolina, and Virginia. Monthly or daily mean discharges were highest of record for the month in parts of New York, West Virginia, and Virginia, and lowest of record for the month in parts of Idaho, Michigan, Minnesota, Utah, and Wisconsin.

Monthly mean flows remained in the above-normal range in New York, several New England States, and parts of some Southern and Western States and increased into that range in the Atlantic Provinces, most of the remaining States in the Northeast region, and large areas of Southeastern United States. Flows remained in the below-normal range in many of the North-Central States and decreased into that range in parts of California, Montana, Oklahoma, and Washington.



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NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow generally increased seasonally throughout the region except for parts of Quebec. Monthly mean flows remained in the above-normal range in the central parts of the region and increased into that range in the Atlantic Provinces and in the southern parts of the region. Major flooding occurred in central Maryland and parts of Pennsylvania. Record-high monthly mean flows occurred in parts of New York.

Rapid runoff from heavy rains on October 8th and 9th caused severe flooding along many streams in southeastern Pennsylvania and central Maryland. Particularly hard hit was the Frederick area in Maryland where Carroll Creek caused damages reported to be in excess of $5 million. The peak-flow rate of Carroll Creek at Frederick (drainage area, 11.8 sq mi) was 5,400 cfs. Extensive flooding occurred along streams draining both flanks of Catoctin Mountain with record peak flows occurring at several gages in the area. Selected data on stages, discharges, and gaging-station locations are given in the accompanying table and map on pages 4 and 5.

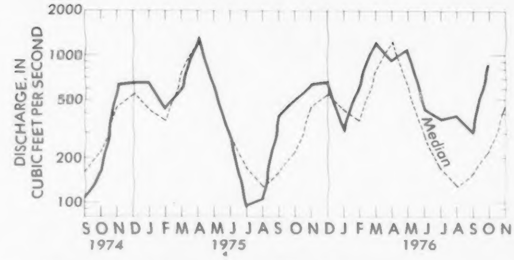
In Pennsylvania, streamflow increased seasonally at all four index stations and ranged from 2.5 to nearly 10 times the median flows for October and were in the above-normal range throughout the State.

Similarly, streamflow in New Jersey was in the above-normal range as a result of above-normal precipitation during the month. At the index station, South Branch Raritan River near High Bridge, monthly mean discharge increased sharply and was over 2 times the median flow.

In south-central New York, monthly mean discharge of Susquehanna River at Conklin was in the above-normal range for the 6th consecutive month. The October monthly mean discharge of 8,500 cfs at Conklin was highest for the month since records began in 1912. In northern New York, monthly mean flows of Hudson River at Hadley, and Mohawk River at Cohoes remained in the above-normal range for the 9th and 6th consecutive months, respectively. Also in northern New York, flow at the index station, West Branch Oswegatchie River near Harrisville, increased sharply to 4 times the median flow and was in the above-normal range. (See graph.) In the central part of the State, discharge of Oneida Creek at Oneida near midmonth was at an alltime high since records began in 1949.

Runoff was in the above-normal range throughout Connecticut and western Massachusetts. The monthly mean flow at Pomperaug River at Southbury, Conn. (drainage area, 75.0 square miles) increased sharply into the above-normal range and was over 5 times the median flow for October.

Similarly in New Hampshire, flow of Pemigewassett River at Plymouth was nearly 5 times the October median and in the above-normal range for the 3d consecutive month. In adjacent Vermont, flow at the index station, White River at West Hartford, was in the above-normal range for the 4th consecutive month.



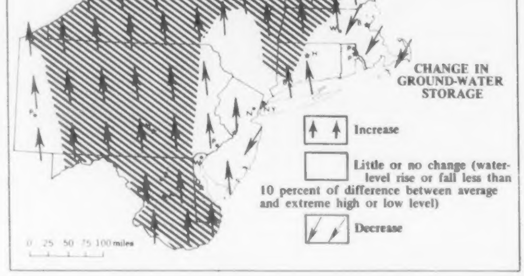
Monthly mean discharge of West Branch Oswegatchie River near Harrisville, N.Y. (Drainage area, 258 sq mi; 668 sq km)

Streamflow in Maine was in the above-normal range for the 4th consecutive month at all index stations. The monthly mean discharge of 176 cfs at Little Androscoggin River near South Paris was over 6 times the median for October.

Monthly mean discharge in New Brunswick and Nova Scotia increased seasonally and was in the above-normal range at all index stations.

In Quebec, streamflow was in the above-normal range south of the St. Lawrence River and generally in the normal range in the remainder of the Province.

Ground-water levels rose in nearly the entire region. (See map.) Exceptions included declining levels in coastal New Jersey (northern part) and in southeastern Massachusetts; little or no fluctuation occurred in wells in some other parts of southern New England. Levels near the end of the month were above average in most of the same areas in which rises occurred, reaching highest end-of-October levels in at least 30 years in some wells in New York, Pennsylvania, and Maine. Levels were near average in parts of the coastal States, from Massachusetts to Delaware.



Map shows ground-water storage near end of October and change in ground-water storage from end of September to end of October.

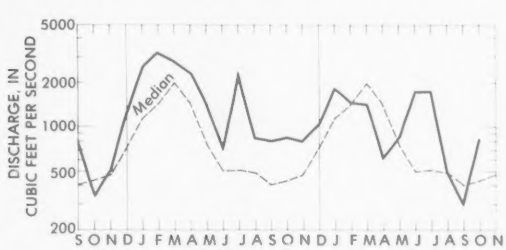
SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally increased seasonally in much of the region but decreased in parts of Alabama, Florida, and Mississippi. Flows remained in the above-normal range in parts of Kentucky, Mississippi, and Tennessee, and increased into that range in parts of Florida, Georgia, North Carolina, South Carolina, Virginia, and West Virginia. Monthly and daily mean discharges were highest for the month in parts of Virginia and West Virginia. Flooding occurred in parts of North Carolina and South Carolina.

Extensive flooding occurred along several streams in the Santee River basin in western North Carolina and the adjacent area of South Carolina early in the month. Rainfall of 2 to 4 inches occurred in those areas during the last week of September and was followed by amounts of 6 to 7 inches October 7–9. Flooding was especially severe along Little Sugar Creek and Sugar Creek at Pineville, N.C. Damages in that town were estimated at $300,000. Data on stages, discharges, and locations of selected measurement sites are given on the map and table on pages 4 and 5. Also in western North Carolina, monthly mean flow at the index station, South Yadkin River near Mocksville, increased sharply and was about 4 times the October median.

In eastern South Carolina, where flow of Lynches River at Effingham was in the below-normal range and only 73 percent of median in September, monthly mean flow increased sharply, into the above-normal range, and was 2 times the median discharge for October. (See graph.)



Monthly mean discharge of Lynches River at Effingham, S.C. (Drainage area, 1,030 sq mi; 2,670 sq km)

In eastern, western, and southern parts of Georgia, flows also increased sharply into the above-normal range and were 2 to 3 times median for the month.

In Tennessee and Kentucky, where September flows were in the above-normal range, monthly mean discharges generally increased contraseasonally, were as much as 8 times the October medians at some stations, and remained in the above-normal range.

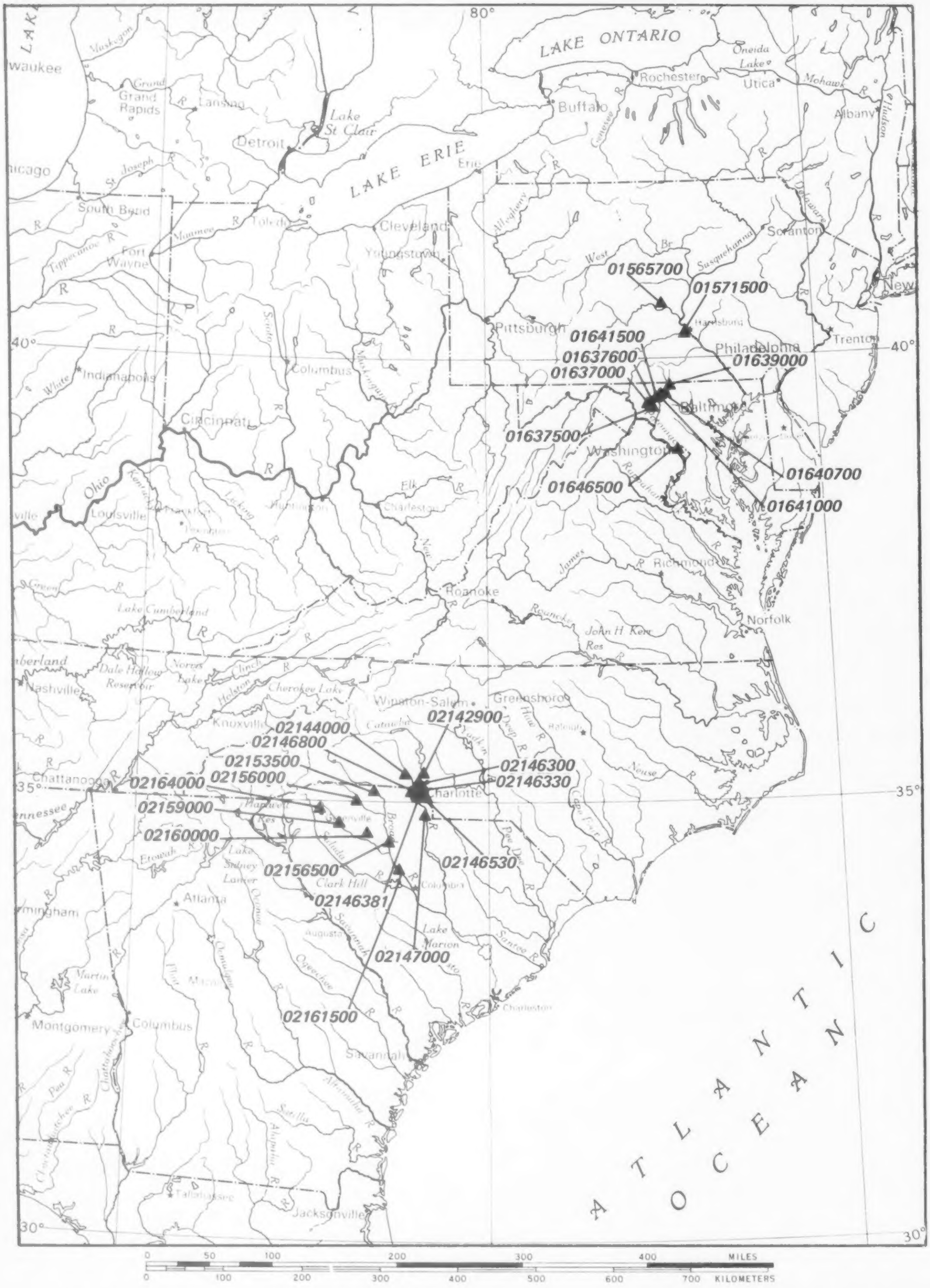
In Virginia and West Virginia, runoff from the heavy rains of October 8, 9, resulted in some flooding along small streams, and in sharply increased monthly mean flows (into the above-normal range) at all index stations. In the extreme western part of Virginia, the monthly mean discharge of 921 cfs, and the daily mean of 7,650 cfs on October 9, in North Fork Holston River near Saltville (drainage area, 222 square miles) were highest for the month in 57 years of record. Similarly, in the east-central part of the State, the monthly mean flow of 793 cfs in Slate River near Arvonia (drainage area, 226 square miles) was 11 times the median for October and highest for the month since records began in April 1926. In southeastern West Virginia, the monthly mean discharge of 4,461 cfs (13 times median), and the daily mean of 33,200 cfs on October 10, at the index station, Greenbrier River at Alderson (drainage area, 1,357 square miles) were highest for the month in records that began in July 1895. In the northeastern part of that State, the monthly mean flow of 9,774 cfs in Potomac River at Paw Paw (drainage area, 3,109 square miles) was highest for the month since records began in October 1938.

In Alabama and Mississippi, monthly mean discharges decreased seasonally and were in the normal range except in Tombigbee River at Columbus, Miss., where high carryover flow from September held the mean discharge in the above-normal range.

In the Apalachicola River basin in northwestern Florida, eastern Alabama, and western Georgia, monthly mean discharge in the main stem, as measured at Chattahoochee, Fla., increased contraseasonally and was above the normal range. In west-central Florida, flow in Peace River at Arcadia decreased seasonally, was only about one-half of the October median, and was less than median flow for the 3d consecutive month. Elsewhere in the State, monthly mean discharges generally were above median and in the normal range.

Ground-water levels rose in most of West Virginia, and a new high for October in 23 years of record was reached in the index well at Glenville; levels were above average in most of the State. The level in the key well near Petersburg, Virginia, rose and was above average at the end of the month. In North Carolina, levels rose in the Coastal Plain but declined elsewhere in the State; below-average levels prevailed, except in the mountains. A new low level for October, in 23 years of record, was recorded in the key well in the Memphis area in western Tennessee, despite a rise of nearly a foot during the month. Levels generally declined seasonally but were

(Continued on page 6.)



Map of part of eastern United States showing location of stream-measurement sites described in the table of peak stages and discharges.

Provisional data; subject to revision

STAGES AND DISCHARGES FOR THE FLOODS OF OCTOBER 1976 AT SELECTED SITES IN PENNSYLVANIA, MARYLAND, NORTH CAROLINA, AND SOUTH CAROLINA

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Discharge (cfs)	Date	Stage (feet)	Discharge		Recurrence interval (years)
									Cfs	Cfs per square mile	
PENNSYLVANIA											
SUSQUEHANNA RIVER BASIN											
01565700	Little Lost Creek at Oakland Mills.	6.52	1960–	June 22, 1972	8.41	468	Oct. 9	8.83	1,350	207	......
01571500	Yellow Breeches Creek near Camp Hill.	216	1909–19, 1954–	June 22, 1972	18.33	15,900	9	11.69	6,340	29	12
MARYLAND											
POTOMAC RIVER BASIN											
01637000	Little Catoctin Creek at Harmony.	8.83	1948–	Aug. 20, 1952	8.49	5,400	Oct. 9	9.29	6,300	713	>50
01637500	Catoctin Creek near Middletown.	66.9	1947–	June 22, 1972	12.28	11,200	9	14.13	[a]12,000	18	>100
01637600	Hollow Road Creek near Middletown.	2.3	1965–	June 21, 1972	8.8	815	9	13.3	2,100	913	>100
01639000	Monocacy River at Bridgeport.	173	1942–	June 22, 1972	[b]24.05	21,300	9	23.19	19,000	110	50
01640700	Owens Creek tributary near Rocky Ridge.	1.2	1967–	July 9, 1970	13.4	383	9	17.7	1,400	1,170	>100
01641000	Hunting Creek at Jimtown.	18.4	1949–	Sept. 26, 1975	5.48	1,930	9	6.32	3,300	179	>100
01641500	Fishing Creek near Lewistown.	7.29	1947–	June 21, 1972	4.01	610	9	5.75	2,200	302	[c]3
01646500	Potomac River near Washington, D.C.	11,560	1930–	Mar. 19, 1936	28.1	484,000	11	13.18	189,000	16.3	<10
NORTH CAROLINA											
SANTEE RIVER BASIN											
02142900	Long Creek near Paw Creek.	16.1	1965–	May 30, 1975	11.46	3,720	Oct. 9	11.50	4,000	248	18
02144000	Long Creek near Bessemer City.	31.4	1952–	Oct. 16, 1971	9.10	6,500	9	8.46	4,400	140	23
02146300	Irwin Creek near Charlotte.	30.5	1962–	May 30, 1975	18.04	8,880	9	16.38	6,400	210	18
02146330	Sugar Creek near Charlotte.	43.7	1962–	May 30, 1975	576.64	7,400	9	577.79	[a]8,500	195	30
02146381	Sugar Creek at Highway 51 at Pineville.	64.5	1969–	Sept. 23, 1975	538.0	9,100	9	540.37	[a]14,000	217	>200
02146530	Little Sugar Creek at Pineville.	48.7	1965–	June 15, 1973	549.7	5,400	9	550.05	[a]6,000	164	<10
02146800	Sugar Creek near Ft. Mill, South Carolina.	262	1974–	Sept. 23, 1975	23.44	16,400	9	26.25	22,900	87	35
SOUTH CAROLINA											
SANTEE RIVER BASIN											
02147000	Catawba River near Catawba.	3,530	1969–	Apr. 1, 1973	17.16	37,500	Oct. 9	23.81	73,600	21	50
02153500	Broad River at Gaffney...	1,490	1938–	Aug. 14, 1940	19.78	119,000	10	17.24	84,900	57	50
02156000	Pacolet River near Clifton.	320	1940–	Aug. 14, 1940	21.19	26,800	9	21.70	27,700	87	100
02156500	Broad River near Carlisle..	2,790	1939–	Aug. 15, 1940	29.41	103,000	10	31.51	123,000	44	50
02159000	South Tyger River near Woodruff.	174	1934–	Apr. 6, 1936	9.78	9,510	9	8.62	7,730	44	20
02160000	Fairforest Creek near Union.	183	1940–	Apr. 8, 1964	7.83	7,720	9	9.43	11,700	64	50
02161500	Broad River at Richtex...	4,850	1926–	Oct. 3, 1929	30.7	228,000	11	23.67	146,000	30	20
02164000	Reedy River near Greenville.	48.6	1942–	Mar. 6, 1963	10.12	4,050	9	10.90	4,450	92	25

[a]Estimated.
[b]Flood of Aug. 24, 1933, reached a stage of about 25 feet, exceeding that of June 1889.
[c]Ratio of discharge to that of a 50-year flood.

(Continued from page 3.)
above average in Kentucky; in downtown Louisville, levels continued to rise slightly because of decreased pumping. In the Jackson area in central Mississippi, levels in wells screened in the Sparta Sand resumed their decline in October, after slight leveling-off in late September; the declines in this area ranged from about one-half to more than 1 foot. Artesian pressures continued to decline in the two index wells in central Alabama, but were nearly a foot above average. In Georgia, levels in most wells in the Piedmont continued their seasonal decline. In the heavily pumped coastal areas, levels in the Savannah area near the center of pumping reached as much as 8 feet lower than last month, but in the outlying areas they remained about the same. In the Brunswick area to the south, levels were about the same as last month near the center of pumping but declined somewhat in outlying areas. They were generally lower than a year ago, and thus still reflected the reduction in pumpage by one of the larger industries during several months in 1975. Ground-water levels declined in most areas of northern Florida during October. Declines were less than 1 foot at Pensacola, Jacksonville, near Ocala, at Orlando, and near Mulberry in west-central Polk County. End-of-month levels ranged from 9.1 feet below average near Mulberry to 9.8 feet above average north of Tallahassee. In southeastern Florida, levels continued to decline during the month, then rose slightly in isolated areas of Dade County. End-of-month levels ranged from 0.3 foot to 2.7 feet below the average.

WESTERN GREAT LAKES REGION

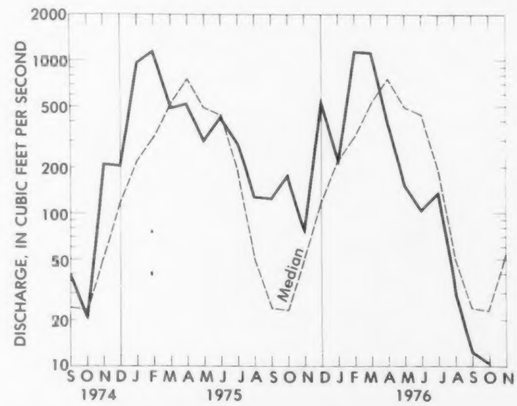
[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow increased in most parts of the region but remained in the below-normal range in Minnesota, Wisconsin, northern Michigan, and southwestern Ontario. Monthly mean flows were in the above-normal range in parts of Ohio and were lowest of record in parts of Michigan and Wisconsin.

In central Ohio, monthly mean flow of Scioto River at Higby decreased seasonally, was over 2 times the median and remained in the above-normal range for the 4th consecutive month. Similarly, in eastern Ohio, flow at the index station, Little Beaver Creek near East Liverpool, increased seasonally to about 3 times the October median and remained in the above-normal range.

By contrast, in Michigan's Upper Peninsula, streamflow was below the normal range for the 6th consecutive month and the monthly mean flow of 11.9 cfs at the index station, Sturgeon River at Sidnaw, was a new monthly minimum for the 4th consecutive month. In the northern part of the Lower Peninsula, monthly mean discharge at Muskegon River at Evart remained in the below-normal range for the 2d consecutive month and was only 70 percent of the median flow.

In northern Illinois, monthly mean discharge at the index station, Pecatonica River at Freeport, increased contraseasonally but remained in the below-normal range for the 5th consecutive month. In the central part of the State, streamflow at Sangamon River at Monticello decreased seasonally, was only 44 percent of median but within the normal range. (See graph.)



Monthly mean discharge of Sangamon River at Monticello, Ill. (Drainage area, 550 sq mi; 1,424 sq km)

In Wisconsin, streamflow increased slightly at several index stations but remained in the below-normal range throughout the State. The October monthly mean discharges of 795 cfs in Chippewa River at Chippewa Falls, and 2,698 cfs in Wisconsin River at Muscoda were lowest of record in 88 and 62 years, respectively.

Similary, in Minnesota, streamflow increased contraseasonally but remained in the below-normal range for most of the State and was lowest of record for October except for the northwestern and southeastern corners. Some new instantaneous minimums of record occurred in the northeastern part of the State. The monthly mean flow of 7.5 cfs at Buffalo River near Dilworth (drainage area, 1,040 square miles) was 20 percent of median and the daily flow of 1 cfs on October 8 was a record low daily flow for October for the period of record that began in 1931.

In the adjacent areas of southwestern Ontario, streamflow was variable but remained in the below-normal range. Monthly mean flow at the index-station, Missinaibi River at Mattice (drainage area, 3,450 square miles) increased seasonally to 14 percent of median and remained in the below-normal range for the 6th consecutive month.

(Continued on page 8.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 157; Ontario, 1.22.)

Lake	October 31, 1976	Monthly mean, October		October		
		1976	1975	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.50	600.67	601.20	600.96	601.93 (1951)	599.49 (1925)
Michigan and Huron (Harbor Beach, Mich.)	579.10	579.37	579.85	578.26	580.45 (1973)	575.77 (1964)
St. Clair (St. Clair Shores, Mich.)	574.47	574.68	575.10	573.22	575.35 (1973)	571.13 (1934)
Erie (Cleveland, Ohio)	571.50	571.74	572.08	570.12	572.14 (1973)	567.95 (1934)
Ontario (Oswego, N.Y.)	244.80	245.00	244.55	244.31	246.33 (1945)	241.72 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	October 31, 1976	October 31, 1975	Reference period 1904–75		
			October average, 1904–75	October maximum (year)	October minimum (year)
Elevation in feet above mean sea level:	4,200.30	4,200.05	4,197.5	4,204.0 (1923)	4,191.35 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1975): 102.1 (1869). Alltime low (1863–1975): 92.17 (1941).	October 31, 1976	October 31, 1975	Reference period 1939–75		
			October average, 1939–75	October max. daily (year)	October min. daily (year)
Elevation in feet above mean sea level:	97.46	96.57	94.43	97.96 (1946)	92.90 (1942)

FLORIDA

Site	October 1976		September 1976	October 1975
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	800	95	790	670
Miami Canal at Miami (southeastern Florida)	320	68	291	250
Tamiami Canal outlets, 40-mile bend to Monroe	553	93	861	998

Ground-water levels in shallow water-table wells in Minnesota rose but remained below average in the northern half of the State and declined and remained below average in the southern half. The level in the key well near Hanska, in south-central Minnesota, was the lowest for October in 34 years of record. In the Minneapolis-St. Paul area, artesian levels continued to rise in wells tapping the Prairie du Chien-Jordan aquifer and the deeper Mt. Simon-Hinckley aquifer; both were below average. In Wisconsin, levels in the deep aquifers generally declined but were in the normal range. In most areas in Michigan, levels declined but were above average in the southern part of the Lower Peninsula and generally below average elsewhere. The level at the index well in northern Illinois rose during October and remained above average. Levels rose and were above normal in central Ohio, but declined and remained within the normal range in northeastern Ohio.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

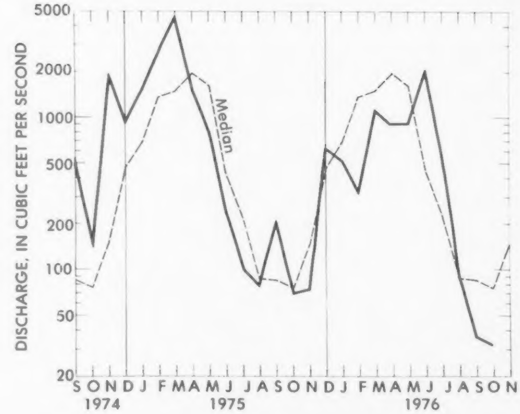
Streamflow decreased seasonally in Arkansas and Oklahoma, increased in Missouri and Nebraska and was variable elsewhere in the region. Monthly mean flows were in the below-normal range in parts of all States in the region. Flows remained in the above-normal range in parts of Texas.

Streamflow in Texas was in the below-normal range in the Panhandle area and in the above-normal range in the South Concho River basin (27th consecutive month). Monthly mean flow at the index station, Neches River near Rockland, remained in the above-normal range for the 4th consecutive month.

In Louisiana, monthly mean flow at the index station, Amite River near Denham Springs, decreased seasonally to 77 percent of median and was in the below-normal range for the first time since February 1975.

In Oklahoma, monthly mean discharge at Washita River near Durwood decreased seasonally into the below-normal range (35 percent of median) and below the median discharge for the 6th consecutive month.

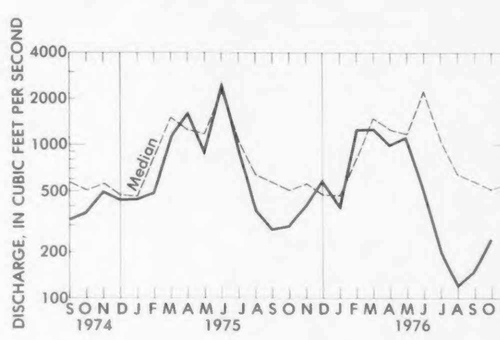
In southern Missouri and northern Arkansas, streamflow was in the below-normal range. Monthly mean discharge of Gasconade River at Jerome, Mo., increased seasonally but remained in the below-normal range for the 3d consecutive month. Flow at the index station, Buffalo River near St. Joe, Ark., decreased seasonally to 44 percent of the median and remained in the below-normal range for the 2d consecutive month. (See graph.)



Monthly mean discharge of Buffalo River near St. Joe, Ark. (Drainage area, 829 sq mi; 2,147 sq km)

Monthly mean discharges at all index stations in Iowa continued to decrease seasonally and remained below median. Flow at the index station, Des Moines River at Fort Dodge was only 13 percent of median and in the below-normal range for the 7th consecutive month. In the eastern part of the State, the monthly mean flow of 570 cfs at Cedar River at Cedar Rapids (drainage area, 6,510 square miles) was less than 50 percent of median and in the below-normal range for the 4th consecutive month.

Below-normal flows persisted in eastern Nebraska. For example, monthly mean discharge at the index station, Elkhorn River at Waterloo, although increasing contraseasonally, remained in the below-normal range for the 5th consecutive month. (See graph.)



Monthly mean discharge of Elkhorn River at Waterloo, Nebr. (Drainage area, 6,900 sq mi; 17,900 sq km)

Streamflow at both index stations in South Dakota continued in the below-normal range as a result of below-normal precipitation. Flow of Bad River near Fort Pierre has been non-existent since June 6, 1976 and in the below-normal range for the 8th consecutive month.

Similarly in adjacent North Dakota, streamflow remained in the below-normal range and continued to show the effects of drought conditions. For example, monthly mean flow of Red River of the North at Grand Forks, was only 29 percent of the median flow and in the below-normal range for the 2d consecutive month.

In Manitoba, the level of Lake Winnipeg at Gimli averaged 712.65 feet above mean sea level for the month, 0.97 foot below the long-term mean. The maximum lake level for this month occurred in 1974 when the mean was 716.41 feet.

Ground-water levels declined in North Dakota, in eastern Nebraska and Kansas, and in the Austin area in southeastern Texas, but generally rose elsewhere in the region. In North Dakota, drought conditions continued despite light snowfall over much of the State; levels continued to decline and were at or near record lows for the third consecutive month. Levels generally rose in Nebraska and at month's end were near long-term averages; however, a new low for the end of October was recorded in the shallow well near Ashland in the eastern part of the State. In Kansas, there were minor fluctuations but levels showed no definite trends; levels were generally below average. In the rice-growing area of east-central Arkansas, the water level in the shallow aquifer rose slightly, continuing in the same range that has prevailed since 1955. In the industrial aquifer of central and southern Arkansas—the Sparta Sand—the level in the key wells at Pine Bluff and at El Dorado rose but continued below average. Withdrawals from the Sparta Sand in northern Louisiana and from the Miocene aquifer in the Alexandria area caused slight declines in water levels. In the terrace aquifer of central Louisiana, levels declined because of deficient rainfall. Water levels in the Chicot aquifer of southwestern Louisiana rose during the month, but levels in the Baton Rouge and New Orleans areas showed mixed trends but generally little change. In Texas, levels rose at San Antonio, Houston, and El Paso, but declined at Austin. A new October low, in 19 years of record, was recorded in the well in the bolson deposits at El Paso, and a new alltime low was noted in the well in the Ogallala Formation at Plainview. Levels were above average in the Edwards Limestone at Austin and San Antonio, but below average in the Evangeline aquifer at Houston and in the bolson deposits at El Paso.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

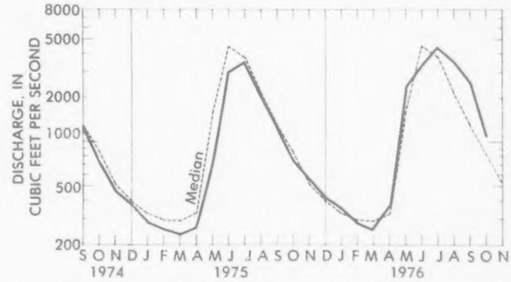
Streamflow generally decreased in Alberta, British Columbia, Arizona, California, and Montana, but was variable in all other States in the region. Flows remained in the above-normal range in a large area in Alberta and British Columbia, and in smaller areas in California, Idaho, Montana, and Nevada. Monthly mean discharges remained in the below-normal range in parts of Arizona, New Mexico, and Utah, and decreased into that range in parts of California, Montana, Oregon, and Washington. Record-low flows occurred in parts of Idaho and Utah.

In northern California, monthly mean flows at the index stations, Smith River near Crescent City and North Fork American River at North Fork Dam, continued to decrease because of lack of precipitation in the area, and were below the normal range and only about one-half of the October median flows. In the central part of the State, high carryover flow from September held monthly mean discharge of Kings River above North Fork in the above-normal range. A tropical storm struck the south-coastal area near Santa Barbara October 1. The resulting intense rainfall of nearly 3½ inches in one hour resulted in extensive damage to buildings, vehicles, highways, and crops.

In Oregon, at the north-coastal index station, Wilson River near Tillamook, monthly mean flow decreased contraseasonally, was only 14 percent of median, and was below the normal range. In other parts of the State, flows increased in some basins and decreased in others but were in the normal range.

In western Washington, monthly mean discharge was variable but was in the below-normal range and only about one-third of median. In the eastern part of the State, flow of Spokane River at Spokane increased seasonally but was below the normal range.

In Alberta and British Columbia, streamflow decreased seasonally but remained in the above-normal range in the Fraser and Bow River basins. For example, monthly mean discharge at Bow River at Banff, Alberta, decreased to 127 percent of median but remained in the above-normal range for the 3d consecutive month. (See graph.)



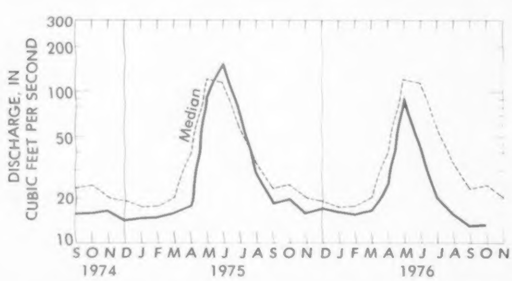
Monthly mean discharge of Bow River at Banff, Alberta
(Drainage area, 858 sq mi; 2,222 sq km)

In Idaho, monthly mean flows at the index stations, Snake River near Heise and Snake River at Weiser, in the southern part of the State, were in the above-normal range. In the central and northern parts of the States, flows in Salmon River and Clearwater River basins decreased contraseasonally and were in the normal range. Flow in Coeur d' Alene River, in northern Idaho, was the lowest in 23 years of record.

In the adjacent area of western Montana, monthly mean discharges of Middle Fork Flathead River near West Glacier and Marias River near Shelby decreased contraseasonally into the below-normal range. In south-central Montana, flow of Yellowstone River at Billings decreased seasonally but remained in the above-normal range for the 12th time in the past 13 months. In the west-central part of the State, monthly mean flow in Clark Fork at St. Regis decreased contraseasonally and was in the normal range. This was the second month since October 1975 that monthly mean flow was not in the above-normal range at this station.

In northeastern Nevada, flow of Humboldt River at Palisade increased seasonally and remained above the normal range.

In southwestern Utah, the monthly mean discharge of 12.9 cfs in Beaver River near Beaver (drainage area, 82 square miles) was lowest for October since records began in March 1914. (See graph.) The daily mean discharge of



Monthly mean discharge of Beaver River near Beaver, Utah (Drainage area, 82 sq mi; 212 sq km)

11 cfs on October 21 was only 1 cfs greater than the minimum daily for the month, which occurred in 1934. In the northeastern part of the State, monthly mean discharges in Weber River near Oakley and Whiterocks River near Whiterocks decreased seasonally and were below the normal range. In the east-central and southeastern parts of the State, mean flows in Green River at Green River and San Juan River near Bluff increased but remained in the below-normal range.

In central Colorado, on the east slope of the Continental Divide, monthly mean discharge of Arkansas River at Canon City increased contraseasonally as a result of releases from Twin Lakes Reservoir and Turquoise Lake, and was above the normal range. In the adjacent basin of Roaring Fork River, on the west slope of the Continental Divide, the monthly mean flow at Glenwood Springs increased seasonally and was in the above-normal range.

In New Mexico, flow in Pecos River at Santa Rosa decreased sharply, was only about one-half of the October median flow, and was below the normal range. Elsewhere in the State, monthly mean flows were less than median but within the normal range.

In southeastern Arizona, mean flow of Gila River at head of Safford Valley, near Solomon, also decreased sharply, was about one-half the October median, and in the below-normal range for the 2d time in 3 months. In the west-central part of the State, monthly mean discharge of Verde River below Tangle Creek, above Horseshoe Dam, decreased seasonally but was above the normal range. In northwestern Arizona, where monthly mean flow of Virgin River at Littlefield was below median during the past 7 months, flow increased sharply into the above-normal range and was 2 times the October median.

Storage for irrigation in southern Idaho was above average and storage for power in northern Idaho was below average. Contents of major reservoirs in the Colorado-Big Thompson project in Colorado were below normal. Contents of major reservoirs in northern California were 71 percent of average and 57 percent of the storage at the end of October 1975. Storage in most reservoirs in Washington was near normal. Contents of the Colorado River Storage Project decreased 503,400 acre-feet during the month.

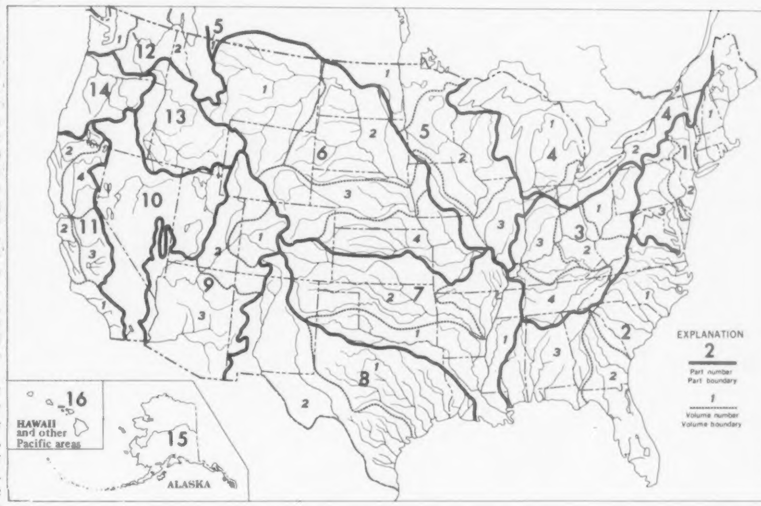
Ground-water levels rose in the key well for Spokane, in eastern Washington, and was above average, although below the level of a year ago. In the Boise Valley, Idaho, the level in the well in the sand and gravel aquifer continued its seasonal decline but was slightly above average; levels in key wells in the Snake River Plain generally rose slightly but remained below average. In Montana, levels generally declined; the key well in terrace gravel at Stevensville, despite a slight rise, was more than 6 feet below the previous record low for October in 20 years of record. Levels were below average in all index wells in southern California, although rises were noted in three of the wells; the greatest rise, nearly 10 feet, was recorded at the artesian well for the Lompoc area in the Santa Ynez Valley. In Utah, water levels generally rose except in the Blanding area in the southeastern part of the State where declines were slight; levels were below average in the Holladay and Flowell areas and above average in the Logan and Blanding areas. In Arizona, although water levels both rose and fell, new October lows were recorded at all index wells except the

(Continued on page 17.)

REPORTS ON STREAM DISCHARGES IN THE UNITED STATES, WATER YEARS 1966–70

The U.S. Geological Survey has published 35 of 37 volumes that present, in each volume, a 5-year compilation of records of streamflow and of the elevation and contents of lakes and reservoirs in the United States during the period October 1, 1965 through September 30, 1970. Daily streamflows are given as well as monthly and annual flow summaries. Each report is identified by a number in the water-supply paper series of publications as well as by a part (region) and volume (sub-region) number. The part and volume numbers of each report correspond to those shown on the map at right, thus identifying the geographical area covered by the data in the report. Many State, municipal, and private organizations have assisted by furnishing data or helping to collect data. Funds or services have also been provided by several other Federal agencies. Beginning with water year 1971, the annual, monthly, and daily data are published by the Survey in a series limited to State-by-State annual basic data reports instead of in the water-supply paper series.

The publications listed below are available for reference in many large public and university libraries. The volumes may be purchased at the prices shown from the U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey). Requests for specific unpublished data may be directed to the appropriate district office of the Geological Survey.



U.S. GEOLOGICAL SURVEY WATER-SUPPLY PAPER (Note: When ordering any report listed below, add the following title immediately after the water-supply paper number, "Surface water supply of the United States, 1966–70.")

		Station numbers included in volume[1]
2101.	Part 1. North Atlantic slope basins—Volume 1, Basins from Maine to Connecticut. 1,123 pages. 1975. $8.60.	1–0100 to 1–2121
2102.	Part 1, North Atlantic slope basins—Volume 2, Basins from New York to Delaware. 985 pages. 1976. $7.00.	1–3000 to 1–485.5
2103.	Part 1, North Atlantic slope basins—Volume 3, Basins from Maryland to York River. 971 pages. 1976. $7.00.	1–4848 to 1–6745
2104.	Part 2, South Atlantic slope and eastern Gulf of Mexico basins—Volume 1, Basins from James River to Savannah River. 1,018 pages. 1974. $6.60.	2–0095 to 2–1985
2105.	Part 2, South Atlantic slope and eastern Gulf of Mexico basins—Volume 2, Basins from Ogeechee River to Carrabelle River. 797 pages. 1975. $6.35.	2–1997 to 2–3304
2106.	Part 2, South Atlantic slope and eastern Gulf of Mexico basins—Volume 3, Basins from Apalachicola River to Pearl River. 764 pages. 1975. $6.15.	2–3310 to 2–4926
2107.	Part 3, Ohio River basin—Volume 1, Ohio River basin above Kanawha River. 668 pages. 1976. $5.45.	3–0080 to 3–1600.5
2108.	Part 3, Ohio River basin—Volume 2, Ohio River basin from Kanawha River to Louisville, Kentucky. 700 pages. 1972. $5.60.	3–1606.1 to 3–2945
2109.	Part 3, Ohio River basin—Volume 3, Ohio River basin from Louisville, Kentucky, to Wabash River. 633 pages. 1975. $5.20.	3–2945 to 3–3816
2110.	Part 3, Ohio River basin—Volume 4, Ohio River basin below Wabash River. 806 pages. 1973. $5.40.	3–3820.25 to 3–6140
2111.	Part 4, St. Lawrence River basin—Volume 1, Basins of streams tributary to Lakes Superior, Michigan, and Huron. 754 pages. 1974. $5.10.	4–0010 to 4–1585
2112.	Part 4, St. Lawrence River basin—Volume 2, St. Lawrence River basin below Lake Huron. 738 pages. 1976. $5.50.	4–1593 to 4–2965
2113.	Part 5, Hudson Bay and upper Mississippi River basins—Volume 1, Hudson Bay basin. 425 pages. 1976. $4.10.	5–0107 to 5–1405
2114.	Part 5, Hudson Bay and upper Mississippi River basins—Volume 2, Upper Mississippi River basin above Keokuk, Iowa. 785 pages. 1976. $6.30.	5–2000.1 to 5–4745
2115.	Part 5, Hudson Bay and upper Mississippi River basins—Volume 3, Upper Mississippi River basin below Keokuk, Iowa. 607 pages. 1973. $3.90.	5–4747.5 to 5–6000
2116.	Part 6, Missouri River basin—Volume 1, Missouri River basin above Williston, North Dakota. 835 pages. 1974. $5.60.	6–0110 to 6–3301
2117.	Part 6, Missouri River basin—Volume 2, Missouri River basin from Williston, North Dakota, to Sioux City, Iowa. 612 pages. 1973. $3.95.	6–3310 to 6–4860
2118.	Part 6, Missouri River basin—Volume 3, Missouri River basin from Sioux City, Iowa, to Nebraska City, Nebraska. 710 pages. 1973. $5.65.	6–4860 to 6–8070
2119.	Part 6, Missouri River basin—Volume 4, Missouri River basin below Nebraska City, Nebraska. 901 pages. 1972. $6.95.	6–8070 to 6–9358
2120.	Part 7, Lower Mississippi River basin—Volume 1, Lower Mississippi River basin except Arkansas River basin. 1,278 pages. 1975. $9.60.	7–0100 to 7–0782.1 7–2654.5 to 7–3867
2121.	Part 7, Lower Mississippi River basin—Volume 2, Arkansas River basin 931 pages. 1974. $6.15	7–0812 to 7–2641
2122.	Part 8, Western Gulf of Mexico basins—Volume 1, Basins from Mermentau River to Colorado River. 1,144 pages. 1975. $8.75.	8–0100 to 8–1625
2123.	Part 8, Western Gulf of Mexico basins—Volume 2, Basins from Lavaca River to Rio Grande. 861 pages. 1974. $5.70.	8–1626.5 to 8–5000
2124.	Part 9, Colorado River basin—Volume 1, Colorado River basin above Green River. 543 pages. 1973. $3.85.	9–0100 to 9–1870
2125.	Part 9, Colorado River basin—Volume 2, Colorado River basin from Green River to Compact Point. 634 pages. 1973. $4.40.	9–1885 to 9–3830
2126.	Part 9, Colorado River basin—Volume 3, Lower Colorado River basin. 681 pages. 1975. $5.55.	9–3830 to 9–5375
2127.	Part 10, The Great Basin. 1,143 pages. 1974. $7.35.	10–0100 to 10–4071.5
2128.	Part 11, Pacific slope basins in California—Volume 1, Basins from Tijuana River to Santa Maria River. 552 pages. 1976. $5.00.	11–0100 to 11–1410
2129.	Part 11, Pacific slope basins in California—Volume 2, Basins from Arroyo Grande to Oregon State line except Central Valley. 678 pages. 1976. $5.55.	11–1411.5 to 11–1851.5 11–4559.5 to 11–5330
2130.	Part 11, Pacific slope basins in California—Volume 3, Southern Central Valley basins. 670 pages. 1976. $5.25.	11–1853 to 11–3375
2131.	Part 11, Pacific slope basins in California—Volume 4, Northern Central Valley basins. 747 pages. 1976. $5.85.	11–3395 to 11–4541
2132.	Part 12, Pacific slope basins in Washington—Volume 1, Pacific slope basins in Washington except Columbia River basin. 640 pages. 1974. $4.40.	12–0095 to 12–2500
2133.	Part 12, Pacific slope basins in Washington—Volume 2, Upper Columbia River basin. 674 pages. 1975. $5.50.	12–3000 to 12–5140
2134.	Part 13, Snake River basin. 821 pages. 1974. $5.50.	13–0105 to 13–3530.5
2135.	Part 14, Pacific slope basins in Oregon and lower Columbia River basin. 1,036 pages. 1972. $7.85.	14–0100 to 14–4000
2136.	Part 15, Alaska. 428 pages. (In press.)	15–0080 to 15–7460
2137.	Part 16, Hawaii and other Pacific areas. 750 pages. (In press.)	16–0100 to 16–9600

[1] The numbers as listed are shown in the short form formerly in use. The full numbers, designed for computer purposes and printouts, consist of 8 digits with no punctuation. For example, the full numbers for 1–4845.5 and 14–4000 are 01484550 and 14400000, respectively.

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR OCTOBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	October data of following calendar years	Stream discharge during month: Mean (cfs)	Dissolved-solids concentration during month[a]: Minimum (mg/L)	Dissolved-solids concentration during month[a]: Maximum (mg/L)	Dissolved-solids discharge during month[a]: Mean (tons per day)	Dissolved-solids discharge during month[a]: Minimum (tons per day)	Dissolved-solids discharge during month[a]: Maximum (tons per day)	Water temperature during month[b]: Mean, in °C	Water temperature during month[b]: Minimum, in °C	Water temperature during month[b]: Maximum, in °C
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1976*	18,200	83	104	2,225	1,640	3,410	16.0	16.0	16.5
	(Morrisville, Pa.)	1944–75	6,054	58 (Oct. 11–20, 1945)	156 (Oct. 1–9, 1953)	....	463 (Oct. 31, 1963)	8,300 (Oct. 11–20,1955)	.....	8.5	25.5
			[4,025[c]]								
04264331	St. Lawrence River at	1976	302,000	166	166	135,000	134,000	137,000	12.0	0.0	16.0
	Cornwall, Ontario, near	1975	289,000	167	168	130,000	127,000	132,000	14.0	12.5	16.0
	Massena, N.Y. (streamflow station formerly at Ogdensburg, N.Y.)	1966–75	270,400 [234,500[c]]	....	....	....	....	....	14.5	10.0	19.5
	SOUTHEAST										
07289000	Mississippi River at	1976	269,700	243	271	187,000	117,000	284,000	19.0	15.0	23.5
	Vicksburg, Miss	1975	441,400 [264,200[c]]	192	258	275,000	228,000	338,000	19.5	17.5	23.0
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1976	189,900	196	292	....	55,000	262,000	.....	14.5	24.0
	(25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1954–75,	107,900 [89,100[c]]	135 (Oct. 10, 1960; Oct. 24, 1963)	330 (Oct. 9, 1967)	....	15,000 (Oct. 25, 1973)	244,000 (Oct. 26, 1954)	.....	12.0	26.0
	MIDCONTINENT										
06934500	Missouri River at Hermann,	1976	48,200	395	459	55,000	51,800	59,600	14.5	10.0	20.0
	Mo. (60 miles west of St. Louis, Mo.)	1975	79,800 [55,340[c]] [55,340[c]]	383	456	91,800	85,600	98,900	16.5	12.5	20.0
	WEST										
14128910	Columbia River at	1976	142,000	78	90	32,700	20,200	44,100	16.0	14.0	18.0
	Warrendale, Oreg.	1975	115,800	97	108	31,900	26,800	48,900	.....	15.0	19.5
	(30 miles east of Portland, Oreg.; streamflow station at The Dalles, Oreg.)	1967–75	116,500 [100,400[c]]	....	....	....	....	....	.....	11.5	19.5

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved solids are for days 1–6, 20–21; water temperatures are for days 1–6 (only data available for month).

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1976

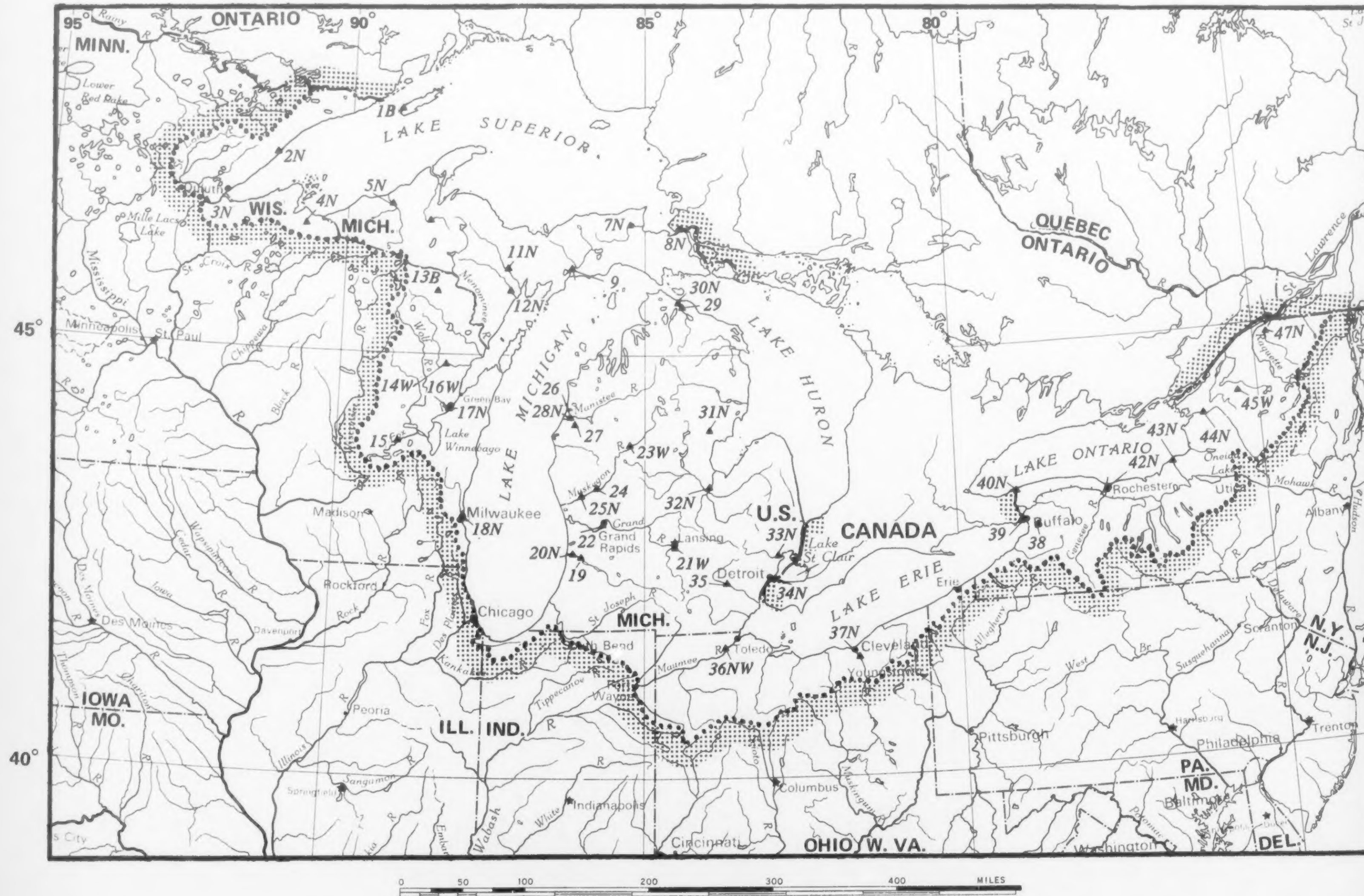
[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Sept. 1976	End of Oct. 1976	End of Oct. 1975	Average for end of Oct.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	54	45	28	32	226,300 (a)
QUEBEC					
Allard (P)	87	91	90	91	280,600 ac-ft
Gouin (P)	86	83	82	83	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	83	91	52	.....	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	51	63	68	76	3,330 mcf
Lake Francis (FPR)	80	90	92	75	4,326 mcf
Lake Winnipesaukee (PR)	75	75	82	53	7,200 mcf
VERMONT					
Harriman (P)	67	73	79	60	5,060 mcf
Somerset (P)	71	80	92	68	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	75	74	82	71	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	79	78	79	56	34,270 mcf
Indian Lake (FMP)	215	106	97	53	4,500 mcf
New York City reservoir system (MW)	83	86	96	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	77	83	101	64	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	40	33	36	29	51,400 mcf
Pymatuning (FMR)	88	88	95	76	8,191 mcf
Raystown Lake (FR)	65	63	56	33	33,190 mcf
Lake Wallenpaupack (PR)	62	72	72	47	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	93	98	99	84	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	90	88	98	80	12,580 mcf
Narrows (Badin Lake) (P)	97	98	97	96	5,617 mcf
High Rock Lake (P)	71	75	91	57	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	78	83	78	60	70,300 mcf
Lakes Marion and Moultrie (P)	86	95	75	63	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	68	69	74	52	75,360 mcf
GEORGIA					
Burton (PR)	89	83	84	64	104,000 ac-ft
Sinclair (MPR)	82	80	86	71	214,000 ac-ft
Lake Sidney Lanier (FMPR)	55	54	64	49	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	85	83	87	65	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	34	38	33	32	1,156,000 cfsd
Douglas Lake (FPR)	32	38	39	22	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	66	53	56	48	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	44	49	44	38	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	51	35	48	47	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	63	64	76	75	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	25	21	47	62	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	14	11	28	29	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	92	89	94	.....	22,640,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	60	60	59	73	127,600 ac-ft
Bell Fourche (I)	5	11	25	36	185,200 ac-ft
Lake Francis Case (FIP)	78	66	61	56	4,834,000 ac-ft
Lake Oahe (FIP)	81	80	88	.....	22,530,000 ac-ft
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	101	103	102	91	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	96	95	97	95	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	62	66	70	67	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	75	72	82	84	2,378,000 ac-ft
Keystone (FPR)	69	66	75	89	661,000 ac-ft
Tenkiller Ferry (FPR)	87	78	99	89	628,200 ac-ft
Lake Altus (FIMR)	58	56	87	47	134,500 ac-ft
Lake O'The Cherokees (FPR)	77	72	75	82	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	93	90	94	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	88	86	92	43	386,400 ac-ft
Canyon (FMR)	90	94	90	65	385,600 ac-ft
International Amistad (FIMPW)	100	101	100	72	3,497,000 ac-ft
International Falcon (FIMPW)	100	100	....	75	2,667,000 ac-ft
Livingston (IMW)	100	100	100	68	1,788,000 ac-ft
Possum Kingdom (IMPRW)	96	93	93	102	569,400 ac-ft
Red Bluff (PI)	21	21	36	28	307,000 ac-ft
Toledo Bend (P)	83	88	85	72	4,472,000 ac-ft
Twin Buttes (FIM)	91	92	94	17	177,800 ac-ft
Lake Kemp (IMW)	63	68	83	88	268,000 ac-ft
Lake Meredith (FMW)	40	41	46	38	821,300 ac-ft
Lake Travis (FIMPRW)	90	91	91	79	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	99	97	96	85	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	94	94	93	97	5,232,000 ac-ft
Lake Chelan (PR)	93	80	76	73	676,100 ac-ft
Lake Cushman	95	81	101	86	359,500 ac-ft
Lake Merwin (P)	104	97	101	83	246,000 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	54	54	57	47	1,235,000 ac-ft
Coeur d'Alene Lake (P)	79	54	62	54	238,500 ac-ft
Pend Oreille Lake (FP)	91	44	62	73	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	54	58	62	50	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	92	92	88	82	802,000 ac-ft
Buffalo Bill (IP)	77	68	67	75	421,300 ac-ft
Keyhole (F)	67	66	68	39	199,900 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	55	55	60	41	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	0	0	0	12	364,400 ac-ft
Taylor Park (IR)	62	61	79	53	106,200 ac-ft
Colorado–Big Thompson project (I)	52	49	71	56	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	80	78	82	.....	31,280,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	82	79	81	57	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	42	42	72	54	1,000,000 ac-ft
Hetch Hetchy (MP)	35	28	66	48	360,400 ac-ft
Isabella (FIR)	12	13	31	22	551,800 ac-ft
Pine Flat (FI)	20	23	39	36	1,014,000 ac-ft
Clair Engle Lake (Lewiston) (P)	62	55	80	72	2,438,000 ac-ft
Lake Almanor (P)	57	55	88	47	1,036,000 ac-ft
Lake Berryessa (FIMW)	65	64	86	75	1,600,000 ac-ft
Millerton Lake (FI)	43	46	34	31	503,200 ac-ft
Shasta Lake (FIPR)	29	33	80	65	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	42	37	78	50	744,600 ac-ft
NEVADA					
Rye Patch (I)	69	64	81	.....	157,200 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	78	79	77	68	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	0	0	12	12	1,093,000 ac-ft
Salt and Verde River system (IMPR)	49	48	50	33	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	24	24	23	76	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	13	14	21	24	2,539,000 ac-ft

[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage)

GREAT LAKES WATER RESOURCES REGION

The Great Lakes Region (U.S. part only) is region 4 of the 21 water resources regions defined by the U.S. Water Resources Council. The regional boundary is the United States—Canada international boundary on the north, through Lakes Superior, Huron, St. Clair, Erie, and Ontario, and is along river-basin divides (heavy-dot border) elsewhere. The entire region drains into the St. Lawrence River. Region 4 has a total U.S. area of about 180,000 square miles (470,000 sq km), including some 60,000 square miles (160,000 sq km) of water surface in the U.S. parts of the Great Lakes. Principal river basins include St. Louis River (Minn.), Fox River (Wis.), Grand River (Mich.), Saginaw River (Mich.), Maumee River (Ohio), and Oswego River (N.Y.) basins.



SELECTED DATA FOR SOME KEY STREAM STATIONS IN THE GREAT LAKES REGION

The stream stations listed below include, for this region, all sites presently in the National Stream Quality Accounting Network (NASQAN), all Geological Survey hydrologic bench-mark stream-gaging stations: all U.S. (and U.S.-Canada boundary) river stations of the International Hydrological Decade (IHD, 1965–74), and all U.S. index and large-river stations that are used each month in compiling the Water Resources Review. Streams are listed in downstream order within the Great Lakes-St. Lawrence River basin, from west to east.

The map number identifies NASQAN sites by "N," the hydrologic bench-mark stations by "B," and Water Resources Review stations by "W." The IHD stations are those with map numbers 16W, 22, 36NW, and 46NW. Of the 27 NASQAN ("N") stations, radiochemical sampling is carried out at stations 8N and 46NW, and pesticide sampling at stations 3N, 7N, 17N, 20N, 28N, 30N, 33N, 37N, and 44N.

Station number, name, and drainage area of 47 sites

Number on map	USGS station number	Site	Drainage area (sq mi)	Average discharge; years of record (cfs)	Within hydrologic cataloging unit--
1B	04001000	Washington Creek at Windigo, Isle Royale, Mich	13.2	19.8/11	04020300
2N	04014500	Baptism River near Beaver Bay, Minn	140	168/48	04010101
3N	04024000	St. Louis River at Scanlon, Minn	3,430	2,294/67	04010201
4N	04027000	Bad River near Odanah, Wis	611	613/35	04010302
5N	04040000	Ontonagon River near Rockland, Mich	1,340	1,414/33	04020102
6W	04040500	Sturgeon River near Sidnaw, Mich	171	212/35	04020104
7N	04045500	Tahquamenon River near Tahquamenon Paradise, Mich	790	924/22	04020202
8N	04045580	St. Marys River above Sault Ste. Marie, Mich	80,900	....	04020203
9	04056500	Manistique River near Manistique, Mich	1,100	1,410/37	04060106
10N	04057005	Manistique River at Manistique, Mich	1,450	....	04060106
11N	04059000	Escanaba River at Cornell, Mich	870	896/34	04030110
12N	04059500	Ford River near Hyde, Mich	450	376/21	04030109
13B	04063700	Popple River near Fence, Wis	131	123/12	04030108
14W	04071000	Oconto River near Gillett, Wis	678	581/64	04030104
15	04073500	Fox River at Berlin, Wis	1,430	1,094/77	04030201
16W	04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wis	6,150	4,185/79	04030204
17N	04085000	Fox River at Wrightstown, Wis	6,210	....	04030204
18N	04087000	Milwaukee River at Milwaukee, Wis	686	398/61	04040003
19	04108500	Kalamazoo River near Fennville, Mich	1,600	1,374/45	04050003
20N	04108690	Kalamazoo River at Saugatuck, Mich	2,020	....	04050003
21W	04112500	Red Cedar River at East Lansing, Mich	355	206/45	04050004
22	04119000	Grand River at Grand Rapids, Mich	4,900	3,534/49	04050006
23W	04121500	Muskegon River at Evart, Mich	1,450	986/43	04060102
24	04122000	Muskegon River at Newaygo, Mich	2,350	1,947/53	04060102
25N	04122030	Muskegon River near Bridgeton, Mich	2,420	....	04060102
26	04126000	Manistee River near Manistee, Mich	1,780	1,987/24	04060103
27	04126200	Little Manistee River near Freesoil, Mich	200	175/19	04060103
28N	04126520	Manistee River at Manistee, Mich	2,000	....	04060103
29	04130000	Cheboygan River near Cheboygan, Mich	865	813/33	04070004
30N	04132052	Cheboygan River at Cheboygan, Mich	1,500	....	04070004
31N	04142000	Rifle River near Sterling, Mich	320	308/39	04080101
32N	04157000	Saginaw River at Saginaw, Mich	6,060	....	04080206
33N	04165500	Clinton River at Mount Clemens, Mich	734	515/41	04090003
34N	04165700	Detroit River at Detroit, Mich	228,800	....	04090004
35	04174500	Huron River at Ann Arbor, Mich	729	449/71	04090005
36NW	04193500	Maumee River at Waterville, Ohio	6,330	4,797/50	04100009
37N	04208000	Cuyahoga River at Independence, Ohio	707	782/44	04110002
38	04214500	Buffalo Creek at Gardenville, N.Y	144	190/37	04120103
39	04216000	Niagara River at Buffalo, N.Y	264,000	203,000/115	04120103
40N	04219640	Niagara River (Lake Ontario) at Fort Niagara, N.Y	265,000	....	04120104
41	04232000	Genesee River at Rochester, N.Y.	2,457	2,725/68	04130003
42N	04232006	Genesee River at Charlotte Docks, at Rochester, N.Y	....	....	04130003
43N	04249000	Oswego River at Lock 7, Oswego, N.Y	5,098	6,505/42	04140203
44N	04260500	Black River at Watertown, N.Y	1,876	3,902/55	04150101
45W	04262500	West Branch Oswegatchie River near Harrisville, N.Y	258	502/59	04150302
46NW	04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y	299,000	241,100/115	04150301
47N	04269000	St. Regis River at Brasher Center, N.Y	616	1,008/65	04150306

Mean and extreme discharges at eight long-term stream-gaging stations

Number on map	Stream	Maximum discharge; month-year (cfs)	Minimum discharge; month-year (cfs)	Average discharge; 1941–70 (cfs)	Average discharge (1941–70) by months, expressed as percent of average discharge for entire 30-water-year period (percent)											
					Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
3N	St. Louis	37,900/5-50	80/8-63	2,540	46	46	62	256	216	150	94	72	72	76	59	51
16W	Fox	24,000/4-52	138/8-36	3,940	99	95	114	170	138	121	85	59	56	73	93	96
22	Grand	54,000/3-04	381/8-36	3,470	97	114	208	199	144	90	58	41	44	53	70	83
36NW	Maumee	[a]94,000/2-50	(c)/....	4,810	145	172	220	204	139	78	43	21	13	26	49	96
41	Genesee	[b]48,300/3-16	(d)/....	2,710	94	117	227	235	139	74	42	33	33	46	70	94
43N	Oswego	37,500/3-36	30/11-44	6,290	121	123	183	199	129	81	49	35	38	47	77	121
44N	Black	36,700/4-63	10/9-34	3,790	92	88	149	260	134	69	47	41	51	67	99	104
46NW	St. Lawrence	351,000/7,8-73	139,000/2-36	239,000	93	93	96	102	105	107	107	105	101	97	96	96

[a]Estimated peak discharge, March 1913, 180,000 cfs.
[b]Maximum discharge known, about 54,000 cfs, March 18, 1965.
[c]Practically no flow at times prior to June 30, 1929, when entire river flow was being diverted by canal.
[d]Less than 10 cfs, during low-water periods when powerplant was shut down.

FLOW OF LARGE RIVERS DURING OCTOBER 1976

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	October 1976: Monthly discharge (cfs)	October 1976: Percent of median monthly discharge, 1941–70	October 1976: Change in discharge from previous month (percent)	Discharge near end of month (cfs)	Discharge near end of month (mgd)	Discharge near end of month: Date
1–0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	13,640	290	+76	11,800	7,630	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,791	4,730	393	+210	4,300	2,780	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,450	8,760	383	+232	....	....	....
1–4635	Delaware River at Trenton, N.J	6,780	11,360	18,266	454	+324	26,200	16,900	27
1–5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	77,040	980	+644	72,800	47,100	31
1–6465	Potomac River near Washington, D.C.	11,560	[1] 10,640	33,700	1,183	+1,180	13,500	8,730	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	2,324	110	+245	1,830	1,180	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,098	12,000	258	+338	12,300	7,950	27
2–2260	Altamaha River at Doctortown, Ga.	13,600	13,380	12,110	229	+134	18,800	12,200	28
2–3205	Suwannee River at Branford, Fla	7,740	6,775	4,690	102	+2	5,220	3,370	29
2–3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	15,600	143	+24	18,200	11,800	28
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	2,877	107	-59	2,100	1,360	26
2–4895	Pearl River near Bogalusa, La	6,630	8,533	1,517	76	-22	1,400	900	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 18,700	19,970	457	+251	34,000	22,000	27
3–0850	Monongahela River at Braddock, Pa.	7,337	[1] 11,950	20,830	662	+676	32,200	20,800	27
3–1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	25,340	558	+690	28,400	18,400	26
3–2345	Scioto River at Higby, Ohio	5,131	4,337	1,193	205	-10	1,400	900	27
3–2945	Ohio River at Louisville, Ky[2]	91,170	110,600	105,700	470	+267	108,300	70,000	27
3–3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	4,668	114	-4	6,400	4,140	31
3–4690	French Broad River below Douglas Dam, Tenn.	4,543	[1] 6,528	6,593	188	+172	....	....	....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[2]	6,150	4,142	775	36	-24	....	....	....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[3]	299,000	239,100	301,500	129	-2	298,000	193,000	31
050115	St. Maurice River at Grand Mere, Quebec.	16,300	24,900	19,200	105	+126	20,000	12,900	27
5–0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	394	29	-40	250	160	31
5–3300	Minnesota River near Jordan, Minn ..	16,200	3,306	202	21	+9	214	138	28
5–3310	Mississippi River at St. Paul, Minn ...	36,800	[1] 10,230	1,411	23	+26	1,550	1,000	27
5–3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	795	31	0	....	....	....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,457	2,698	49	+3	....	....	....
5–4465	Rock River near Joslin, Ill	9,520	5,288	1,822	76	+5	1,720	1,110	31
5–4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	16,400	52	+6	15,000	9,700	29
5–4855	Des Moines River below Raccoon River at Des Moines, Iowa.	9,879	3,796	173	19	+2	240	160	29
6–2145	Yellowstone River at Billings, Mont.	11,795	6,754	5,139	130	-1	4,600	2,970	31
6–9345	Missouri River at Hermann, Mo	528,200	78,480	48,430	88	+4	51,100	33,000	26
7–2890	Mississippi River at Vicksburg, Miss.[4]	1,144,500	552,700	269,700	102	+37	260,000	168,000	31
7–3310	Washita River near Durwood, Okla ..	7,202	1,379	179	35	-41	160	100	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex.	9,730	732	268	94	....	....	....	....
9–3150	Green River at Green River, Utah ...	40,600	6,369	1,686	68	+14	3,500	2,260	31
11–4255	Sacramento River at Verona, Calif ...	21,257	18,370	7,300	83	-37	7,050	4,560	26
13–2690	Snake River at Weiser, Idaho	69,200	17,670	16,400	113	+6	15,100	9,760	28
13–3170	Salmon River at White Bird, Idaho ..	13,550	11,060	5,965	122	-10	5,750	3,720	28
13–3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	4,510	118	-39	4,740	3,060	28
14–1057	Columbia River at The Dalles, Oreg.[5]	237,000	194,000	141,200	141	-14	....	....	....
14–1910	Willamette River at Salem, Oreg	7,280	23,370	12,050	112	+8	13,320	8,610	26-30
15–5155	Tanana River at Nenana, Alaska	25,600	24,040	13,040	80	-40	10,000	6,460	31
8MF005	Fraser River at Hope, British Columbia.	78,300	95,300	98,500	129	-38	71,300	46,100	27

[1] Adjusted.

[2] Records furnished by Corps of Engineers.

[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.

[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

[5] Discharge (unadjusted) determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

(Continued from page 10.)
well at Nogales. The level in the shallow well in the southern part of the Roswell basin in southeastern New Mexico declined slightly and was below average; the level in the artesian aquifier of the Pecos Valley rose more than 5 feet but nevertheless was at a new low for the end of October.

ALASKA

Streamflow decreased seasonally throughout the State and remained in the below-normal range except for the Kenai Peninsula and most coastal streams. Monthly mean flow at the index stations, Little Susitna River near Palmer and Chena River at Fairbanks, have been in the below-normal range for 3 and 5 consecutive months, respectively.

Ground-water levels in wells tapping deep confined aquifers around Anchorage generally rose ½ to 1 foot or remained unchanged. Levels in the shallow alluvial aquifer remained unchanged from last month.

HAWAII

Streamflow increased seasonally in most of Hawaii and was in the normal range except for Waiakea Stream near Mountain View, where flow decreased seasonally into the below-normal range.

METRIC EQUIVALENTS OF UNITS USED IN THE WATER RESOURCES REVIEW

(Round-number conversions, to nearest four significant figures)

1 foot = 0.3048 meter   1 mile = 1.609 kilometers
1 acre = 0.4047 hectare = 4,047 square meters
1 square mile (sq mi) = 259 hectares = 2.59 square kilometers (sq km)
1 acre-foot (ac-ft) = 1,233 cubic meters
1 million cubic feet (mcf) = 28,320 cubic meters
1 cubic foot per second (cfs) = 0.02832 cubic meters per second = 1.699 cubic meters per minute
1 second-foot-day (cfsd) = 2,447 cubic meters
1 million gallons (mg) = 3,785 cubic meters = 3.785 million liters
1 million gallons per day (mgd) = 694.4 gallons per minute (gpm) = 2.629 cubic meters per minute = 3,785 cubic meters per day

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WATER RESOURCES REVIEW

OCTOBER 1976

Based on reports from the Canadian and U.S. field offices; completed November 10, 1976

EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for October based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for October 1976 is compared with flow for October in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for October is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the October flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of October. Water level in each key observation well is compared with average level for the end of October determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of September to the end of October.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

HISTORICAL REVIEW OF THE INTERNATIONAL WATER-RESOURCES PROGRAM OF THE U.S. GEOLOGICAL SURVEY 1940–70

The abstract and graph below are from the report, *Historical review of the international water-resources program of the U.S. Geological Survey 1940–70*, by George C. Taylor, Jr.: U.S. Geological Survey Professional Paper 911, 146 pages, 1976. This report may be purchased for $2.90 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, VA 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

The present review describes the history of the U.S. Geological Survey's (USGS) activities in international water-resources investigations and institutional development as well as exchange in scientific and applied hydrology during 1940–70. The bulk of these activities has been carried out under the auspices of the U.S. Department of State, U.S. Agency for International Development and its predecessors, the United Nations and its specialized agencies, and the regional intergovernmental agencies. The central objectives of the USGS' international water-resources activities have been to strengthen the administrative, staff, and operational functions of counterpart governmental hydrological and water-resources agencies; to improve the skills and capabilities of host-country scientific, engineering, and technical personnel; to exchange research specialists and publications in the sharing of advances in hydrological knowledge and methodology; and to participate in mutually beneficial international organizations, symposia, conferences, seminars, and special programs dedicated to various aspects of scientific and applied hydrology.

As the USGS is a domestic agency, its activities outside the United States must be covered by legislative authorization. Enabling legislation in force in 1970 included Public Laws 80-402, 85-743, 85-795, 87-195, 87-256, 87-626, and 91-175 of the U.S. Congress. USGS water-resources activities in the U.S. bilateral program were financed at an average level of $525,000 during 1950–70, peaking at $1,040,000 in fiscal year 1966. (See figure 1.) This funding is exclusive of counterpart funds in other currencies provided by foreign governments in support of project costs.

Between 1940 and 1970, USGS hydrogeologists, water chemists, engineers, and hydrologists completed 340 short and long-term project-oriented international assignments in some 80 host countries. During the same time more than 428 water scientists, engineers, and technicians from 60 countries have received academic and in-service training through USGS water-resources facilities in the United States. Also in this period some 336 reports of a technical and scientific nature have resulted from water-resources projects in the U.S. bilateral program.

The USGS as of 1970 had been participating in international water-resources technical assistance projects for almost three decades and since the early 1960's also has been deeply involved in international exchange related to scientific and applied hydrology. Political events and age-old social and cultural constraints have presented many obstacles to goals of building viable hydrologic and water-resources institutions in the developing countries. Nevertheless, significant advances have been made in many of these countries which the USGS helped to achieve. Also between 1965 and 1970 the USGS played an active role in UNESCO's International Hydrological Decade, which already has had a marked impact in sparking advances of hydrologic knowledge among the developed countries as well as in the application of the scientific method to the solution of water problems in the developing countries.

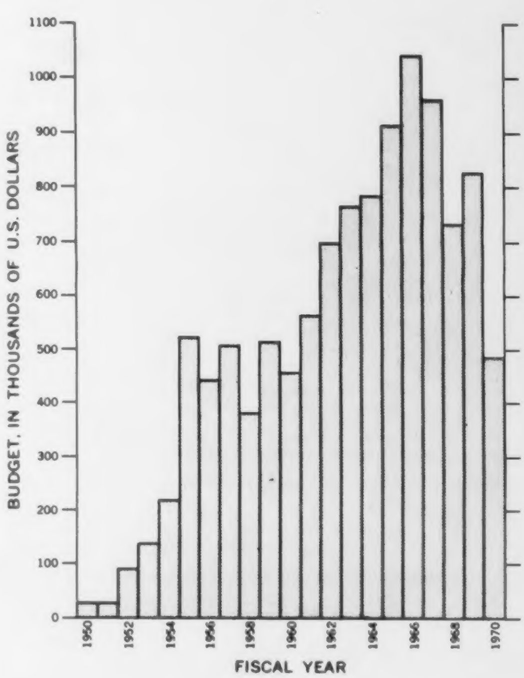

Figure 1.—–Distribution of USGS water resources foreign program funds by fiscal years, 1950–70.